

Atty. Docket No. CPAC 1014-4
Appl. No. 10/608,843

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Remarks

Claims 1 - 18 are in the application. Claims 1, 2 and 11 are amended for improved clarity of presentation. The Title is amended to more accurately describe the invention. No new matter is introduced by the amendment, and entry thereof is requested. Reconsideration of the application, as amended, is requested.

The points raised in the Office action will now be addressed.

Rejections under 35 U.S.C. § 102(b)

Claims 1 and 10 were rejected under 35 U.S.C. § 102(e) as being anticipated by IIuang *et al.* U.S. 6,400,014 ("Huang"). The Examiner substantially repeats the same assertions and arguments as in the previous Office action.

These rejections are again traversed.

As Applicants pointed out earlier, Huang describes heat sinks (Figs. 3 – 7) and completed semiconductor packages having a heat sink (Figs. 1, 8, 9). Huang is silent as to method or process, except as to resin flow.

Particularly, as to Applicants' claim 1, Huang says nothing about placing the heat sink into a mold cavity and then (in a subsequent step) placing the ball grid array over the cavity, as recited in the claim. In "Response to Applicants' Amendment and arguments", the Examiner pointed out that the claims do not recite that the ball grid array is placed over the mold cavity "in a subsequent step" following placing the heat spreader into the mold cavity, and noted that limitations from the specification will not be read into the claims.

This point is addressed as follows: claim 1 is amended herein to recite – following the step of placing the heat spreader into the mold cavity -- to make clear that the step of placing the ball grid array over the mold cavity follows the step of placing the heat spreader into the mold cavity.

Accordingly, the rejection of claim 1 as being anticipated by Huang should be withdrawn.

And particularly, as to Applicants' claim 10, contrary to the Examiner's assertion, Huang says nothing as to at least one supporting arm of the heat spreader being affixed to the substrate using a resilient fixative, as recited in the claim. In "Response to Applicants' Amendment and arguments", the Examiner pointed to Huang col. 3, line 53 to col. 4, line 9, and FIG. 1 as

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supporting an assertion that "Huang discloses that the heat spreader 33 being affixed to the substrate using a resilient fixative." The cited passage reads as follows:

Please refer to FIG. 1, it is a cross-sectional view of the semiconductor package of the present invention. The semiconductor package 3 includes a substrate 30, a chip 31 adhered to the substrate 30, a plurality of gold wires 32 electrically connected to the substrate 30 and the chip 31, and a heat sink 33 disposed on the substrate 30, a resin body 34 for encapsulating the chip 31, the gold wire 32, and a portion of the heat sink 33, and a plurality of solder balls 35 mounted on the bottom surface of the substrate 30.

The substrate 30 has a top surface 300 for laying out a plurality of metal traces (not shown because this is a well-known design), a bottom surface 301 for laying out a plurality of metal traces, and a plurality of vias (not shown) for electrically connecting the plurality of metal traces on the top surface 300 with those on the bottom surface 301. The solder balls 35 are respectively mounted at the ends of the metal traces on the bottom surface 301 for electrically connecting the chip 31 and the substrate 30. Therefore, the chip can be electrically connected with an external device such as a printed circuit board through the solder balls 35. The substrate is made of a material selected from a group consisting of epoxy resin, polyimide resin, triazine, a ceramic material, and a glass material, preferably bismaleimide triazine.

Applicants are unable to find here (or elsewhere in Huang) any suggestion, much less any teaching, of at least one of the supporting arms of the heat spreader being affixed to the substrate using a resilient adhesive, as recited in Applicants' claim 10.

Accordingly, Huang does not teach all the elements of Applicants' claims, and the rejections of claim 10 as being anticipated by Huang should be withdrawn.

Rejections under 35 U.S.C. § 103(a)

Claims 2 – 9 and 11 – 18 were rejected under 35 U.S.C. § 103(a) for obviousness over Huang in view of Brestel U.S. 5,328,811 ("Brestel"). The Examiner substantially repeats the same assertions and arguments as in the previous Office action.

Huang was applied as in the rejections under 35 U.S.C. § 102(e), and as showing a heat spreader made of metal (claims 2 and 11). Brestel is relied upon as teaching treating the undersurface of a copper layer to form a black copper oxide layer (claims 2, 3, 6, 11, 12 and 15);

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for teaching a range of black copper oxide layer thickness (claims 4, 5, 8, 9, 13, 14, 17 and 18); and for teaching micro-etching the copper undersurface of a copper layer (claims 7 and 16).

These rejections are again traversed.

Brestel is directed to forming an electrically conductive pattern in a copper foil on a dielectric substrate, as for example in manufacture of printed circuit boards. The **copper oxide film is eventually removed in the Brestel process, and the copper foil is eventually etched completely through to form the pattern.** The oxide layer as described in Brestel is a sacrificial layer, not employed in the finished product.

In contrast, according to Applicants' invention, the black copper oxide layer is formed on the underside of the heat spreader as a structural feature of the completed package; it is there to enhance the adhesion between the surface of the heat spreader and the underlying molding. And, in contrast, according to Applicants' invention, micro etching is carried out only to an extent sufficient to chemically roughen the surface of the copper heat spreader, again to enhance the adhesion between the heat spreader surface and the underlying molding. (Applicants' page 7, paragraph [0030].)

This point is amplified as follows: claims 2 and 11 are amended to recite -- the black copper oxide layer enhancing adhesion between the undersurface of the heat spreader and the mold compound -- to emphasize that the black copper oxide of Applicants' invention is a part of the finished product.

The oxide layer as described in Brestel is a sacrificial layer, not employed in the finished product, and has nothing to do with adhesion. Accordingly, the person of ordinary skill in manufacture of semiconductor packaging would not look to Brestel to combine with Huang to make Applicants' claimed combinations.

Moreover, Brestel fails to teach the claimed process elements that Huang lacks, as discussed above. Accordingly, no combination of Brestel and Huang makes Applicants' claimed invention, and the rejections for obviousness over combinations of Huang and Brestel should be withdrawn.

In view of the foregoing, all the claims now in the application are believed to be in condition for allowance, and action to that effect is respectfully requested.

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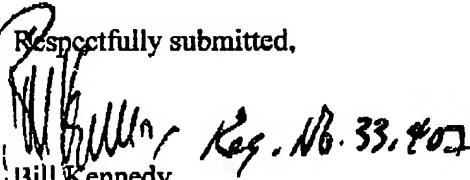
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This Amendment is accompanied by a Notice of Appeal, together with a fee or fee authorization therefor.

This Response is being filed within the three months' shortened statutory period set by the Examiner for response to the Office action and, accordingly, it is believed that no extension of time, or fee therefor, is required in connection with the filing of this paper. In the event the Examiner may determine that an extension of time may be required in connection with the filing of this paper, petition is hereby made therefor, and the Commissioner is authorized to charge any additional fee (or to credit any overpayment) to Deposit Account No. 50-0869 (CPAC 1014-4).

If the Examiner determines that a conference would facilitate prosecution of this application, the Examiner is invited to telephone Applicants' representative, undersigned, at the telephone number set out below.

Respectfully submitted,


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